drical, 100-120 x 7 μ. Sporidia uniseriate, oblong elliptical, 3-septate, scarcely constricted, olive-brown, 12-15 x 3½ μ. The ostiola raise the bark into little pustules which are not very conspicuous.

This comes near P. comptoniæ E. & E.

DIATRYPELLA XANTHOSTROMA E. & E.—On dead limbs of Pirus japonica, London, Canada, Nov. 1903. (Dearness, 2045).

Stroma tubercular-erumpent, 2-4 mm. diam. rather flattened on top and bearing adherent fragments of the ruptured epidermis, black outside, yellow within (the same shade of yellow seen in Hypoxylon sassafras Sz.) Perithecia 4-10 in a stroma, globose or slightly flattened laterally, subfarinaceous outside, about ½ mm. diam., abruptly contracted above into short necks with variable ostiola, papilliform, conical, or obscure, finally rather broadly perforate above. Asci clavate-oblong, 55-65 x 8-10 μ, polysporous. Sporidia allantoid, yellowish-hyaline, slightly curved, 9-10 (exceptionally 9-12 x 2 μ.

This comes near D. frostii Pk. but the sporidia are longer and the yellow color of the stroma inside is different.

UREDINEOUS INFECTION EXPERIMENTS IN 1903.[1]

W. A. KELLERMAN.

Artificial infection experiments with certain species of Puccinia and Uromyces, continuation of those published one year ago, are here reported for the current season, beginning March 5th and ending June 18, 1903. Attention is called to the preceding report where explanations are made relative to the plan and execution of the work — substantially the same being followed during the season now under consideration.

It may be mentioned that pre-season experimentation, or at least very early inoculations, proved very advantageous again, as in the preceding year. For example, in case of the demonstrated connection between Puccinia muhlenbergiæ Arth. & Holw. and Aecidium hibisciatum Schw., quite unexpected, repetition of the inoculation three times was possible, the last time with the host plants growing in their natural habitat. Had this not been possible judgment would perhaps have been held in suspense, but under the circumstances a positive conclusion was not deferred to another year.

Advantageous and desirable as it is to carry on germination tests before making the inoculations, I can not think it objection-

[1] Contributions from the Botanical Laboratory of the Ohio State University. XV.

Presented before the Botanical Society of America, at St. Louis, December, 1903.

able in any case to use material untested or that has proven refractory under trial — and I do not speak wholly without experience in regard to this matter. The artificial conditions that must in all cases obtain, can reasonably be supposed responsible for occasional negative results. In case the spores sown actually infect the host, nothing was gained by the labor and loss of time in the pre-germination tests. These suggestions make it desirable that I insist on the slight stress that should be placed on negative results; they should never be taken as necessarily conclusive. When we reflect on the very many possible causes of failure in connection with any artificial infection no valid objection, in my opinion, can be urged against the view presented. On the other hand a positive result under properly imposed conditions and crucial exactions settles the question at once — though repetition only would satisfy very skeptical minds.

Relative to the experiments outlined below, I may say that twenty-two species of Rusts were used, and in case of nine of them inoculations were successful. This is about the same ratio between success and failure as obtained in the work of the previous season. In a few cases the failure was a foregone conclusion, due to poor "seed" or unsatisfactory host plants; still in spite of the narrow or negative chances of success inoculations were attempted. An unusually large number of tests were made with the Sunflower rust. Nineteen species of Helianthus were used and Rust from four species applied — though unfortunately with very meager results, it must be confessed — and in some other cases an unusually large number of host plants were used; it therefore happened that the total number of inoculations, Nos. 68-260, was relatively quite large, namely 193. Turning now to the details of the experiments, recording briefly the facts in each case and commenting as seems necessary the report is as follows:

PUCCINIA ANGUSTATA Pk. from SCIRPUS ATROVIRENS Muhl.

With material collected at Sandusky, Ohio, in April 1903, repeating the culture of this species — the connection of which with Aecidium lycopi Ger. was originally determined by Dr. Arthur, a single experiment as given below was undertaken. The teleutospores sown on Lycopus americanus produced the aecidia in abundance, thus corroborating Dr. Arthur's work, and obviating the necessity of further explanation here. The record of the experiment is as follows:

Exp. 180. May 28. Teleutospores from Scirpus atrovirens Muhl. applied to Lycopus americanus Muhl. *June 6, spermogonia abundant; June 10, aecidia abundant.*

PUCCINIA CAULICOLA Tr. & Gall. from SALVIA LANCEOLATA Muhl.

Teleutosporic material of this species was kindly sent me by Mr. E. Bartholomew in April 1903 from Rockport, Rooks Co., Kansas. Cultures were made on seedling plants of Salvia lanceolata Muhl. grown in the greenhouse — the seed also furnished by Mr. Bartholomew. Some adventive plants of this western species had previously been found by a roadside in the suburbs of Columbus, Ohio, and they also furnished opportunity for attempted inoculations with the species under consideration. Infections were obtained in case of the seedling plants in the greenhouse — the aecidia appearing in due time though by no means abundant. Re-inoculation at a later date, with teleutospores from same source, was also successful.

This demonstrates the existence of an aecidial stage for this species — not before reported — and establishes the connection of teleutospores and aecidia on the same host. Mr. Bartholomew searched for aecidia in Kansas but found only uredo and teleutospores on the indigenous Salvia lanceolata. Attempted inoculation of the adventive plants at Columbus, Ohio, done under very unfavorable conditions, were not successful.

No spermogonia were seen. A satisfactory diagnosis of the aecidia can not be given from the scant material obtained — about a dozen sori — but the following may be offered:

AECIDIUM CAULICOLUM.— Sori mostly epiphyllous, few, scattered, forming sordid-yellowish spots and which are inconspicuous on the under side of the leaf, less than 0.5 to 1 mm. or more in diameter, circular in outline. On one leaf occurred besides several epiphyllous sori, also a single hypophyllous linear sorus, about 6 mm. long, following a prominent vein near the base of the lamina which it distorted to semicircular outline. Aecidia sometimes limited to one or very few in a sorus, sometimes 10 or 12 (over two dozen in the single linear sorus above described), 210-350 μ diameter, when ruptured the edge somewhat regularly lacerate but scarcely recurved. Peridial cells very large. Aecidiospores pale golden yellow, echinulate, globular to oblong or sub-ovate, 10-25 x 17-20 μ; pores not seen.

Exp. 181. May 28. Teleutospores of Puccinia caulicola Tr. & Gall. applied to seedling plants of Salvia lanceolata Willd. *June 9, scattered amphigenous aecidia.*
Exp. 242. June 17. Same to Salvia lanceolata Willd. *Aecidia noticed July 11,* (perhaps appeared earlier).
Exp. 243. June 17. Same to Urtica gracilis Ait. *No infection.*
Exp. 244. June 17. Same to Monarda fistulosa L. *No infection.*
Exp. 245. June 17. Same to Salvia lanceolata Willd., adventive plants on Greenlawn Ave., Columbus, Ohio. *No infection detected.*

PUCCINIA CARICIS-ERIGERONTIS Arth. from CAREX FESTUCACEA Willd.

I am indebted to Dr. Arthur for culture material for this species, collected in Indiana, April 14, 1903. The experiment besides, was merely a repetition of his own, and proved to be a corroboration of the result formerly published. Abundant aecidia appeared on the Erigeron (Leptilon) but no infection resulted when teleutospores were applied to other hosts as the following record shows.

Exp. 186. May 29. Teleutospores from Carex festucacea Willd., applied to Erigeron pulchellus Mx. (Erigeron bellidifolius Muhl.) *No infection.*
Exp. 187. May 29. Same to Leptilon canadense (L.) Britt. (Erigeron canadense L.). *Abundant spermogonia June 6, and aecidia June 10.*
Exp. 188. May 29. Same to Rudbeckia speciosa Wenderoth. *No infection.*
Exp. 197. May 29. Duplicate of 186. *No infection.*
Exp. 198. May 29. Duplicate of 187. *Infection same as in 187.*

PUCCINIA CARICIS-SOLIDAGINIS Arth. from CAREX STIPATA Muhl.

Abundant Rust for cultures was collected at Buckeye Lake, Ohio, November 1, 1902, and kept in cloth sacks exposed all winter (hanging in a Norway Spruce tree). This was used April 25 on eight different hosts, none but Solidago canadensis becoming infected. It will be noticed from the record below that Solidago riddelii did not seem to be susceptible. Dr. Arthur used Solidago canadensis L., S. serotina Ait., S. caesia L., S. ulmifolia Muhl. and S. rigida L. with success, as given in his report of cultures in Botanical Gazette, January, 1903.

Exp. 151. April 25. Teleutospores from Carex stipata Muhl., applied to Hibiscus moscheutos L. *No infection.*
Exp. 152. April 25. Same to Solidago canadensis L. *Spermogonia appeared May 3, and aecidia May 6.*
Exp. 153. April 25. Same to Solidago riddellii Fr. *No infection.*
Exp. 154. April 25. Same to Verbesina alternifolia (L.) Britt. (Actinomeris squarrosus Nutt.) *No infection.*
Exp. 155. April 25. Same to Erigeron annuus (L). Pers. *No infection.*
Exp. 156. April 25. Same to Carduus altissimus L. *No infection.*
Exp. 157. April 25. Same to Ambrosia trifida L. *No infection.*
Exp. 158. April 25. Same to Rudbeckia speciosa Wenderoth. *No infection.*

PUCCINIA CIRSII-LANCEOLATI Schroet. from CARDUUS LANCEOLATUS L.

This species was described by J. Schroeter, in Kryptogamen-Flora von Schlesien, 317, 1889, (pp. 257-384 published 27 August 1887), aecidia, uredo and teleutospores being included. The Rust on the same host in this country has usually been listed as Puccinia cirsii Lasch by American authors, since the aecidial stage was not in evidence. Having suitable material for culture experiments, work was begun with a view of searching especially for aecidia, March 20th, using as host plants the same species which furnished the teleutospores, namely, Carduus lanceolatus, and many other Compositæ as indicated in the record below. No infections resulted except on Carduus lanceolatus. What at the time were somewhat doubtfully supposed to be spermogonia, are recorded in my notes, but I could not later verify the accuracy of the same; their occurrence is therefore not demonstrated and improbable. But a fair number of the peculiar aecidial sori appeared in due time on two or three leaves of the host plant. Later, uredo and teleutospores followed. Repetitions were not successful — but may have been owing to lateness of season when work was carried on.

When inoculations were instituted specimens were sent to European authority, and the supposition that our material should be called Puccinia cirsii-lanceolati was approved; specimens of European material showing the aecidial stage are now at our service for comparison. The testimony is clear that we have to do with a Eu-Puccinia; it is autœcious. To avoid the necessity of using a 'round about' mode of expression when referring to the aecidial stage it is proposed to use the terminology as follows: *Aecidium cirsii-lanceolati.* Unfortunately Schroeter's description is so meager as the following for the aecidia: "Aecidien in kleinen Gruppen zusammengestellt. Pseudoperidien sehr locker gefügt, weit becherförmig. Sporen elliptisch mit farbloser, feinwarziger Membran und hell orange-rothem Inhalt." Our material accords in the main with the above — but it is being subjected to more careful study and the results, including a fuller description, will be published later. Dates of cultures, etc., are as follows:

Exp. 77. March 20. Teleutospores from Carduus lanceolatus L. applied to Carduus lanceolatus L. *Spermogonia (?) on two plants appeared March 28; aecidia developed April 3; uredo and teleutospores in considerable abundance were observed some time thereafter.* (Record for Spermogonia is now considered incorrect.)

Exp. 78. March 20. Same to Lactuca virosa L. *No infection.*

Exp. 79. March 20. Same to Taraxacum erythrospermum Andrz. *No infection.*

Exp. 80. March 20. Same to Erigeron annuus (L) Pers. *No infection.*
Exp. 83. March 29. Same applied to Carduus lanceolatus L. *No infection.*
Exp. 84. March 29. Same to Chrysanthemum indicum Hort. *No infection.*
Exp. 85. March 29. Same to Taraxacum erythrospermum Andrz. *No infection.*
Evp. 86. March 29. Same to Erigeron annuus (L.) Pers. *No infection.*
Exp. 87. March 29. Same to Lactuca virosa L. *No infection.*
Exp. 119. April 11. Same to Carduus lanceolatus L. *No infection.*
Exp. 120. April 11. Same to Carduus altissimus L. *No infection.*
Exp. 159. May 5. Same to Carduus lanceolatus L. *No infection.*
Exp. 160. May 5. Same to Carduus altissimus L. *No infection.*
Exp. 99. March 30. Aecidiospores from Puccinia cirsii-lanceolati Schroet., applied to Carduus lanceolatus L. *No infection.*

PUCCINIA HELIANTHI Schw. from HELIANTHUS AMBIGUUS (E. & G.) Britt., H. ANNUUS L., H. DECAPETALUS L. and H. MOLLIS Lam.

This species has proven more or less refractory in the hands of recent experimenters. In Europe Woronin, as long ago as 1872 published interesting inoculation experiments, in the Botanische Zeitung No. 38 & 39, 30 Jahrgang, (Sept. 20 & 27), (Aus dem russischen Originale auszüglich mitgetheilt), which he executed at St. Petersburg, Russia, the cultivated Helianthus annuus L. in that country being an important farm crop. His main purpose was to determine whether this prevalent and very damaging species of Rust was the same as that occurring on other Compositæ of that region, and which he rightly decided in the negative. His cultures also were designed to show whether the Rust on "Erdbirne," Helianthus tuberosus, (Puccinia helianthorum Schw.) was the same as the "Sonnenblume" Rust (P. helianthi Schw.). He states that his experiments led him to the conclusion that the two are entirely different, an opinion also shared by de Bary based on his own cultures.

This matter was taken up recently by Ernst Jacky, who reports his results in the Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankh. 2 Abt. 9:802, 6 Dec. 1902. He shows that Puccinia helianthi is an aut-eu-puccinia — the pycnidia, æcidia, uredo and teleutospores produced by sowings of teleutospores from Helianthus annuus, on H. annuus, H. cucumerifolius, and H. californicus, but the species not able to live on H. tuberosus, H. maximiliani, H. multiflorus, H. scaberrimus, and H. rigidus.

In this country Carleton reported work with this Rust, in Science N. S. 13:250, 15 February 1901. His words are as fol-

lows: "Culture experiments were also performed with the common Sunflower Rust, which showed that the Puccinia and Aecidium found on Sunflower are stages of one and the same species. At the same time it is made probable that all the species of Helianthus affected bear the same Rust and that there is no distinction of host forms."

Dr. Arthur sowed teleutospores from Helianthus grosse-serratus Mart. on the same host and on H. maximiliani Schrad.; cultures successful. He adds that sowings at two different dates on H. strumosus gave no infection.

Such facts on record induced me to make as large number of cultures as possible, hoping to furnish worthy testimony in the case. But my success was slight, my failure was great. I used teleutospores from three species of Helianthus as stated above. Inoculations were attempted on nineteen species as hosts, namely, H. annuus, atrorubens, decapetalus, divaricatus, doronicoides, gigantea, grosse-serratus, hirsutus, kellermani, laetiflorus, longifolius, maximiliani, mollis, multiflorus, orgyalis, strumosus, subtuberosus, tracheliifolius, and tuberosus.

I am sorry to record that the only successful inoculations were those with teleutospores of Helianthus mollis Lam. on H. annuus and H. mollis. A few inoculated leaves of each of these two species produced a small number of aecidia. Repetitions with this and other inoculating material were unsuccessful — and the reason for such failure is not clear. The material in case of H. annuus was unfortunately quite small in quantity and at the time not considered satisfactory. That from H. decapetalus and H. ambiguus was abundant but the quality was suspected. But that from H. mollis was apparently in good condition. It had been exposed in the natural habitat all winter, and collected April 2, near Sandusky, Ohio. In spite of the above I do not at all think the negative results of great significance. Of course this Rust on H. mollis will grow on H. annuus, but I do not suppose it will necessarily fail to grow on others — in fact I fully believe at the hands of other experimenters or under other conditions more abundant success will be vouchsafed. It may be well briefly to record the data of the experiments.

Expts. 100-114. April 5. Teleutospores from Helianthus mollis Lam., applied to Helianthus mollis Lam., annuus L., giganteus L., laetiflorus Pers., hirsutus Raf., tuberosus L., orgyalis DC., divaricatus L., mollis Lam., tracheliifolius Mill., strumosus L., atrorubens L., kellermani Britt., and grosse-serratus Mart. *Spermogonia appeared on H. annuus L. (Exp. 101) April 18, and aecidia April 24; ditto H. mollis Lam. (Exp.* 109).

Expts. 170-179. May 24. Same to Helianthus mollis Lam., laetiflorus Pers., maximiliani Schrad., orgyalis DC., kellermani Britt., hirsutus Raf., tuberosus L., giganteus L., subtuberosus Bourg., longifolius Ph. *No infection.*

Expts. 247-254. June 18. Teleutospores of Helianthus mollis from Indiana (sent by Dr. Arthur), applied to Helianthus longifolius Ph., orgyalis DC., mollis Lam., hirsutus Raf., gigantea subtomentosa, laetiflorus Pers., maximiliana Schrad., and atrorubens L. *No infection.*

Expts. 121-137. April 19. Teleutospores from Helianthus annuus applied to Helianthus annuus L., doronicoides Lam., mollis Lam., laetiflorus Pers., hirsutus, Raf., maximiliani Schrad., longifolius Ph., grosse-serratus Mart., laetiflorus Pers., kellermani Britt., giganteus L., subtuberosus Bourg., tracheliifolius Mill., strumosus L., tuberosus L., decapetalus L., multiflorus L. *No infection.*

Expts. 255-260. June 18. Same to Helianthus atrorubens L., hirsutus Raf., mollis Lam., orgyalis DC., subtuberosus Bourg., and Nabalus alba (L.) Hook. (Prenanthes alba L.). *No infection.*

Expts. 69-76. March 5. Teleutospores from Helianthus decapetalus L., applied to decapetalus L., giganteus L., mollis Lam. atrorubens L., kellermani Britt., laetiflorus Pers., orgyalis DC., annuus L. *No infection.*

Expts. 88-98. March 29. Applied teleutospores from Helianthus ambiguus (T. & G.) Britt. to Helianthus annuus L., giganteus L., gigantea subtomentosa, hirsutus Raf., strumosus L., orgyalis DC., laetiflorus Pers., tuberosus L., grosse-serratus Mart., mollis Lam., kellermani Britt. *No infection.*

PUCCINIA HIBISCIATA (Schw.) Kellerm. from MUHLENBERGIA MEXICANA (L.) Trin., M. DIFFUSA Willd., and M. RACEMOSA (Mx.) B. S. P.

The connection established between the teleutosporic stage of this Rust — originally called Puccinia windsoriæ but latterly designated by Arthur and Holway as P. muhlenbergiæ — and the Aecidium hibisciatum Schw. occurring on Hibiscus moscheutos, was published immediately on the conclusion of two sets of satisfactory experiments. See Jour. Mycol. 9:109-110, May 1903. But the report there printed does not cover the entire work with the species in question — dealing as may be recalled only with the Rust from one species only of Muhlenbergia, and with one species only of Hibiscus as the aecidial host.

It is to be added that with similar care and well grounded hopes of success, inoculations were attempted with teleutospores from Muhlenbergia diffusa Willd. This had been collected November 1, 1902, the same day on which the Muhlenbergia mexicana was obtained, and kept exposed all winter in suitable sacks by the side of the latter. Muhlenbergia mexicana was collected on the north shore of Buckeye Lake, Licking Co., Ohio, and M. diffusa was taken a mile distant where (on the south side of the lake) it was common though not abundant.

Aecidium hibisciatum has been for years occurring in great abundance on Hibiscus moscheutos at both of the places just mentioned. No infections were secured, the host plants used

being Hibiscus moscheutos L., H. militaris Cav., and Althaea rosea (Cav.)

Furthermore, Rev. J. M. Bates kindly furnished me from Nebraska, an ample quantity of Muhlenbergia racemosa (Mx.) B.S.P. that harbored the Rust, and the latter was used in an attempted inoculation of Hibiscus moscheutos L., H. militaris Cav., and Napæa dioica L. In no case was an infection secured.

It is not clear how the failures in the above cases should be explained. The apparent conditions were all favorable — though of course no one can pronounce conclusively thereupon. A suggestion may possibly be apropos, namely, that we have here to do with physiological forms restricted to different hosts. The hypothesis signifies nothing however until positive results may be obtained with material from the hosts named. A careful examination by the aid of student J. N. Frank, revealed to us no morphological differences between the spores found on the three species of Muhlenbergia. However the sori on Muhlenbergia mexicana were more numerous — the plants in fact quite blackened with the rust and easily noticed in their natural habitat, at a distance of three or four rods.

Finally it is to be noted that successful inoculations (Exp. 165) were made with teleutospores from Muhlenbergia mexicana on Hibiscus militaris Cav. Attempted infection of several other species of plants of the same and of different orders was not successful. The complete record follows.

Exp. 146. April 24. Teleutospores from Muhlenbergia mexicana (L.) Trin. applied to Hibiscus moscheutos L. *Spermogonia May 5, (abundant May 8); aecidia May 15.*
Exp. 147. April 24. Same to Rudbeckia speciosa Wenderoth. *No infection.*
Exp. 148. April 24. Same to Urtica gracilis Ait. *No infection.*
Exp. 149. April 24. Same to Ambrosia trifida L. *No infection.*
Exp. 150. April 24. Same to Erigeron annuus (L.) Pers. *No infection.*
Exp. 161. May 5. Same to Hibiscus moscheutos L. *Spermogonia abundant May 13, and aecidia later.*
Exp. 162. May 23. Same to Althaea rosea Cav. *No infection.*
Exp. 163. May 23. Same to Malva rotundifolia L. *No infection.*
Exp. 165. May 23. Same to Hibiscus militaris Cav. *Spermogonia June 3, aecidia very abundant* (date lost).
Exp. 222. June 7. Same to Hibiscus moscheutos L. *Aecidia June 16.*
Exp. 223. June 7. Same to Althaea rosea Cav. *No infection.*
Exp. 228. June 8. Same to Abutilon abutilon (L.) Rusby. *No infection.*
Exp. 182. May 28. Teleutospores from Muhlenbergia diffusa Willd. applied to Hibiscus moscheutos L. *No infection.*
Exp. 183. May 28. Same to Althaea rosea Cav. *No infection.*
Exp. 184. May 28. Same to Hibiscus militaris Cav. *No infection.* (Apparently one spermogenial spot — but doubtless to be referred to accidental infection from another experiment.)
Exp. 166. May 24. Teleutospores from Muhlenbergia racemosa (Mx.) B. S. P. applied to Hibiscus moscheutos L. *No infection.*
Exp. 167. May 24. Same to Althaea rosea Cav. *No infection.*
Exp. 168. May 24. Same to Napaea dioica L. *No infection.*
Exp. 169. May 24. Same to Hibiscus militaris Cav. *No infection.*

PUCCINIA LATERIPES Berk. et Rav. from RUELLIA STREPENS L.

A report of the success of cultures of this species has been published on preceding pages (Jour. Mycol. 9:107-9, May 1903), and below are recorded the details of the experiments. It had been assumed perhaps on ample grounds, that this species was autoecious, but heretofore no experiments in artificial infections were on record. It will be found stated in the previous report, and indicated in the record below that what might be termed a 'natural infection' was induced by placing infected soil or humus — old leaves and debris with soil at the base of plants of Ruellia strepens on whose leaves and stems abundant teleutospores were noticed the preceding season — around the host plants in pots in the greenhouse, which were used in the cultures. Besides, infections with teleutospores by the usual method of artificial inoculations was practiced. In a third set of inoculations uredospores (obtained in previous cultures) were used. Pronounced success attended all of the experiments, making a conclusion entirely satisfactory. That the aecidal form of this species has not heretofore been designated by a binomial for convenient reference is unfortunate, and therefore the name here recorded, *Aecidium lateripes,* will obviate future inconvenience. The following is copied from my note book.

Exp. 81. March 5. Soil and humus from base of Ruellia strepens L. known to be infected the preceding year, placed around plants of Ruellia strepens L. in three pots grown in greenhouse since January 30. *Spermogonia appeared* (in case of plants in two pots) *March 23; aecidia developed April 1; later in season very abundant uredospores and teleutospores.*

Exp. 82. April 2. Teleutospores from stems of Ruellia strepens L. exposed all winter but brought into greenhouse March 5, applied to Ruellia strepens L., 3 to 10 inches high. *Aecidia appeared April 10; uredo and teleutospores in abundance in May and June.*

Exp. 115. April 11. Aecidia obtained in Exp. 82 applied to Ruellia strepens L. *Uredo appeared April 25; later a quantity of teleutospores.*

Exp. 138. April 19. Aecidia obtained in Exp. 82, applied to Ruellia strepens L. *Successful* (but date lost).

PUCCINIA SUBNITENS Diet. from DISTICHLIS SPICATA (L.) Greene.

In 1902 Dr. Arthur used material furnished by Rev. J. M. Bates, Nebraska, on Chenopodium album L. and obtained aecidia identified as Aecidium ellisii Tr. & Gall. The same collector also kindly sent me suitable inoculating material on the teleuto-

sporic host named, in March 1903, which was used with success on Chenopodium album L. as the record below shows. Mr. Bates originally suggested a probable connection of the Rust with the Aecidium on Chenepodium leptophyllum (Moq.) Nutt., but as yet no experimental inoculation on this host has been published.

Exp. 220. June 7. Teleutospores applied to Chenopodium album L. *June 21, aecidia abundant.*

The following record of failures, significant perhaps in a few cases, are here set down without further comment.

PUCCINIA CARICINA DC. FROM CAREX COMOSA BOOTT.

Exp. 200. April 5. Teleutospores applied to Urtica gracilis. No infection.

PUCCINIA CARICINA DC. FROM CAREX COSTELLATA BRITT.

Exp. 211. June 6. Teleutospores applied to Urtica gracilis. No infection.
Exp. 211. June 6. Same to Ambrosia trifida L. No infection.
Exp. 213. June 6. Same to Agrimonia parviflora Soland. No infection.
Exp. 214. June 6. Same to Lycopus americanus Muhl. No infection.
Exp. 224. June 7. Same to Xanthoxylum americanum Mill. No infection.

PUCCINIA CARICINA DC. FROM CAREX CRINITA LAM.

Exp. 221. June 7. Teleutospores applied to Leptilon canadense (L.) Britt. No infection.
Exp. 230. June 16. Same to Urtica magellanica Poir. No infection.

PUCCINIA CARICINA DC. FROM CAREX HYSTRICINA MUHL.

Exp. 201. June 6. Teleutospores applied to Urtica gracilis Ait. No infection.
Exp. 202. June 6. Same to Impatiens biflora Walt. No infection.
Exp. 203. June 6. Same to Rudbeckia speciosa Wenderoth. No infection.
Exp. 204. June 6. Same to Eupatorium ageratoides L. f. No infection.

PUCCINIA CARICINA DC. FROM CAREX LANUGINOSA MX.

Exp. 215. June 6. Teleutospores applied to Urtica gracilis Ait. No infection.
Exp. 216. June 6. Teleutospores applied to Solidago flexicaulis L. No infection.
Exp. 217. June 6. Same to Carduus altissimus L. No infection.
Exp. 229. June 8. Same to Leptilon canadense (L.) Britt. No infection.

PUCCINIA CARICINA DC. FROM CAREX LUPULINA MUHL.

Exp. 207. June 6. Teleutospores applied to Urtica gracilis Ait. No infection.
Exp. 208. June 6. Same to Lycopus americanus Muhl. No infection.
Exp. 209. June 6. Same to Cimicifuga recemosa (L.) Nutt. No infection.
Exp. 210. June 6. Same to Erigeron annuus (L.) Pers. No infection.

PUCCINIA CARICINA DC. FROM CAREX SCOPARIA SCHK.

Exp. 199. June 5. Teleutospores from Eugene, Oregon, sent by Professor A. R. Sweetser, applied to Urtica gracilis Ait. No infection.

PUCCINIA CARICINA DC. FROM CAREX SQUARROSA L.

Exp. 205. June 6. Teleutospores applied to Urtica gracilis Ait. No infection.
Exp. 206. June 6. Same to Erigeron annuus (L). Pers. No infection.

PUCCINIA EMACULATA SCHW. FROM PANICUM CAPILLARE, L.

Exp. 231. June 16. Teleutospores applied to Ribes cynosbati L. No infection.
Exp. 232. June 16. Same to Urtica gracilis Ait. No infection.
Exp. 233. June 16. Same to Rumex britannica L. No infection.
Exp. 235. June 16. Same to Aster prenanthoides Muhl. No infection.
Exp. 236. June 16. Same to Lycopus americanus Muhl. No infection.

PUCCINIA IMPATIENTIS (SCHW.) ARTH. FROM ELYMUS VIRGINICUS L.

Exp. 185. May 29. Teleutospores furnished by Dr. Arthur, cult. 148, Indiana, April 17, applied to Impatiens biflora Walt. No infection. Perhaps if the waxy coating of the leaves had been removed more or less completely, the inoculation would have been successful.

PUCCINIA MALVACEARUM BERTERO FROM MALVA BOREALIS WALLM.

Exp. 225. June 7. Teleutospores received from Miss Minnie Reed, Santa Ana, California, February 25, on living plant, applied to Althaea rosea Cav. No infection.
Exp. 226. June 7. Same to Malva rotundifolia L. No infection.
Exp. 227. June 7. Same to Abutilon abutilon (L.) Rusby. No infection.

PUCCINIA MENTHA PERS. FROM KOELLIA VIRGINIANA (L.) MACM.

Exp. 194. May 29. Teleutospores collected at Wauseon, Fulton Co., Ohio, applied to Blephilia hirsuta (Ph.) Torr. No infection.
Exp. 195. May 29. Same to Mentha piperita L. No infection.
Exp. 196. May 29. Same to Monarda fistulosa L. No infection.

PUCCINIA PANICI DIET. FROM PANICUM VIRGATUM L.

Exp. 237. June 17. Teleutospores collected at Sandusky, Ohio, May, applied to Solidago canadensis L. No infection.
Exp. 238. June 17. Same to Aster prenanthoides Muhl. No infection.
Exp. 239. June 17. Same to Agrimonia parviflora Soland. No infection.
Exp. 240. June 17. Same to Urtica gracilis Ait. No infection.

PUCCINIA POCULIFORMIS (JACQ.) WETTST. FROM TRITICUM VULGARE VILL.

Exp. 118. Teleutospores applied to Berberis vulgaris L. No infection.

PUCCINIA POLYGONI-AMPHIBII PERS. FROM POLYGONUM EMERSUM (MX.) BRITT.

Exp. 141. April 24. Teleutospores obtained at Buckeye Lake, Licking Co., Ohio, applied to Hibiscus moscheutos L. No infection.
Exp. 142. April 24. Same to Rudbeckia speciosa Wenderoth. No infection.

Exp. 143. April 24. Same to Urtica gracilis Ait. No infection.
Exp. 144. April 24. Same to Ambrosia trifida L. No infection.
Exp. 145. April 24. Same to Erigeron annuus (L.) Pers. No infection.
Exp. 189. May 29. Teleutospores from Fair Oaks, Indiana, sent by Dr. Arthur, applied to Polygonum emersum (Mx.) Britt. No infection.
Exp. 190. May 29. Same to Rumex verticillatus L. No infection.

PUCCINIA SORGHI SCHW. FROM ZEA MAYS L., SWEET CORN.

Exp. 117. April 11. Teleutospores applied to Zea mays, Yellow Dent Corn. No infection.

PUCCINIA THOMPSONI HUME, FROM CAREX FRANKII KUNTH.

Exp. 191. May 29. Teleutospores applied to Cimicifuga racemosa (L.) Nutt. No infection.
Exp. 192. May 29. Same to Erigeron pulchellus Mx. No infection.
Exp. 193. May 29. Same to Solidago flexicaulis L. No infection.

PUCCINIA VERATRI NIESSL. FROM VERATRUM VIRIDE AIT.

Exp. 149. April 20. Teleutospores collected at Cheat Bridge, West Virginia, applied to Veratrum viride Ait. No infection; but the host plants were in poor condition; not growing and soon died.
Exp. 246. June 18. Same to Veratrum viride Ait. No infection; the host plant was wilted and soon died.

PUCCINIA VILFAE A. & H. FROM SPOROBOLUS LONGIFOLIUS (TORR.) WOOD.

Exp. 218. June 6. Teleutospores furnished by Rev. J. M. Bates, Red Cloud, Nebraska, applied to Chenopodium album L. No infection.
Exp. 219. June 6. Same to Verbena urticaefolia L. No infection.

UROMYCES BURRILLII LAG. FROM SCIRPUS FLUVIATILIS (TORR.) GR.

Exp. 116. April 11. Teleutospores applied to Hibiscus moscheutos L. No infection.
Exp. 139. April 20. Same to Hibiscus moscheutos L. No infection.

SUMMARY OF SUCCESSFUL INOCULATIONS.

Puccinia angustata Peck, teleutospores from Scirpus atrovirens Muhl; obtained aecidia [Aecidium lycopi Ger.] on Lycopus americanus Muhl.

Puccinia caulicola B. & Rav., teleutospores from Salvia lanceolata Willd.; obtained aecidia [Aecidium caulicolum Kellerm.] on Salvia lanceolata Willd.

Puccinia caricis-erigerontis Arth., teleutospores from Carex festucacea Willd.; obtained aecidia (Aecidium erigeronatum Schw.) on Leptilon canadense (L.) Britt.

Puccinia caricis-solidaginis Arth., teleutospores from Carex stipata Muhl.; obtained aecidia on Solidago canadensis L.

Puccinia cirsii-lanceolati Schroet., teleutospores from Carduus lanceolatus L.; obtained aecidia [Aecidium cirsii-lan-

ceolati Kellerm.], uredo and teleutospores on Carduus lanceolatus L.

Puccinia helianthi Schw., teleutospores from Helianthus mollis Lam.; obtained aecidia on Helianthus annuus L. and H. mollis Lam.

Puccinia hibisciata (Schw.) Kellerm., teleutospores from Muhlenbergia mexicana (L.) Trin.; obtained aecidia [Aecidium hibisciatum Schw.] on Hibiscus militaris Cav. and H. moscheutos L.

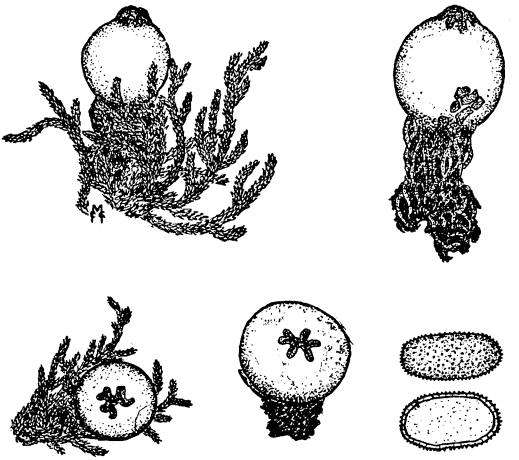
Puccinia lateripes Berk. & Rav., teleutospores from Ruellia strepens. Also aecidiospores from Ruellia strepens L.; obtained aecidia [Aecidium lateripes Kellerm], uredo and teleuto [Puccinia lateripes Berk. & Rav.] on Ruellia strepens L.

Puccinia subnitens Diet., teleutospores from Distichlis spicata (L.) Greene; obtained æcidia on Chenopodium album L.

MINOR MYCOLOGICAL NOTES. II.

W. A. KELLERMAN.

CALOSTOMA CINNABARINUM.— Recently specimens of this uncommon—or uncommonly collected—interesting little Puff-ball were kindly sent by Mrs. Annie Morrill Smith, which were col-



CALOSTOMA CINNABARINUM.

lected by Mrs. Sarah B. Hadley, South Canterbury, Connecticut, November 23, 1903. They represented the mature stage with the spores escaping. As nearly as could be determined they accorded well with the description of that species, but the spores were con-